

A new crayfish of the genus *Orconectes* from the Blood River drainage of western Kentucky and Tennessee (Decapoda: Cambaridae)

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Abstract.—A new crayfish, *Orconectes burri*, is described from the Blood River drainage of western Kentucky and Tennessee. The species occurs in small to medium-sized streams with substrates of gravel and sand. Form I males of *O. burri* differ from all other members of the genus *Orconectes* in possessing a first pleopod with terminal elements that comprise 22 to 29% of the total length of the pleopod, and a central projection with a tip that terminates at an 90° angle to the main shaft of the pleopod, which is either directly above or slightly overhanging the distal end of the mesial process.

Field work conducted in western Tennessee in the spring of 1996 revealed the presence of an undescribed species of crayfish in the headwaters of the Blood River drainage. Subsequent field work in western Kentucky and Tennessee and examination of material housed at the National Museum of Natural History, Smithsonian Institution, indicated that this undescribed form was endemic to the Blood River drainage. Based on the morphology of the form I male pleopod, this new species, described herein as *Orconectes burri*, is assigned to the Rafinesquei group (Fitzpatrick 1987) of the subgenus *Crockerinus* Fitzpatrick 1987. Members of the Rafinesquei group inhabit lotic habitats and are distributed across the western half of Kentucky and extreme southern Illinois. Fitzpatrick (1987) included the following as members of the Rafinesquei group: *Orconectes bisectus* Rhoades, 1944, *O. illinoensis* Brown, 1956, *O. rafinesquei* Rhoades, 1944, *O. tricuspis* Rhoades, 1944.

Orconectes burri, new species

Fig. 1, Table 1

Diagnosis.—Body and eyes pigmented. Rostrum slightly concave dorsally, termi-

nating in short acumen (see Variation); weak median carina present. Rostral margins thickened; distal halves straight and slightly converging, proximal halves slightly convex; terminating in spines (Fig. 1D). Areola 28.8–34.0% ($\bar{X} = 31.0$, $n = 28$, $SD = 1.3$) of total length of carapace, narrowest part slightly anterior of midpoint, 4.4–7.5 ($\bar{X} = 5.7$, $n = 28$, $SD = 0.9$) times as long as wide with 5 to 8 (mode = 6, $n = 28$, $SD = 0.7$) punctations across narrowest part (Fig. 1D). One corneous cervical spine on each side of carapace (Fig. 1D). Post-orbital ridges well developed, terminating in corneous spines (Fig. 1D). Suborbital angle weakly developed, forming broadly rounded projection. Antennal scale broadest distal to midlength, distal margin at 90° angle to lateral margin, thickened lateral margin terminating in large corneous spine (Fig. 1F). Ischia of third pereopods of males with hooks; hooks overreaching basioischial articulation in form I males only. Chela with 2 rows of tubercles (see Variation) along mesial margin of palm, usually 8 or 9 tubercles in mesial row and 6 or 7 in dorsomesial row; small tufts of setae over mesial margin of palm, dorsomesial

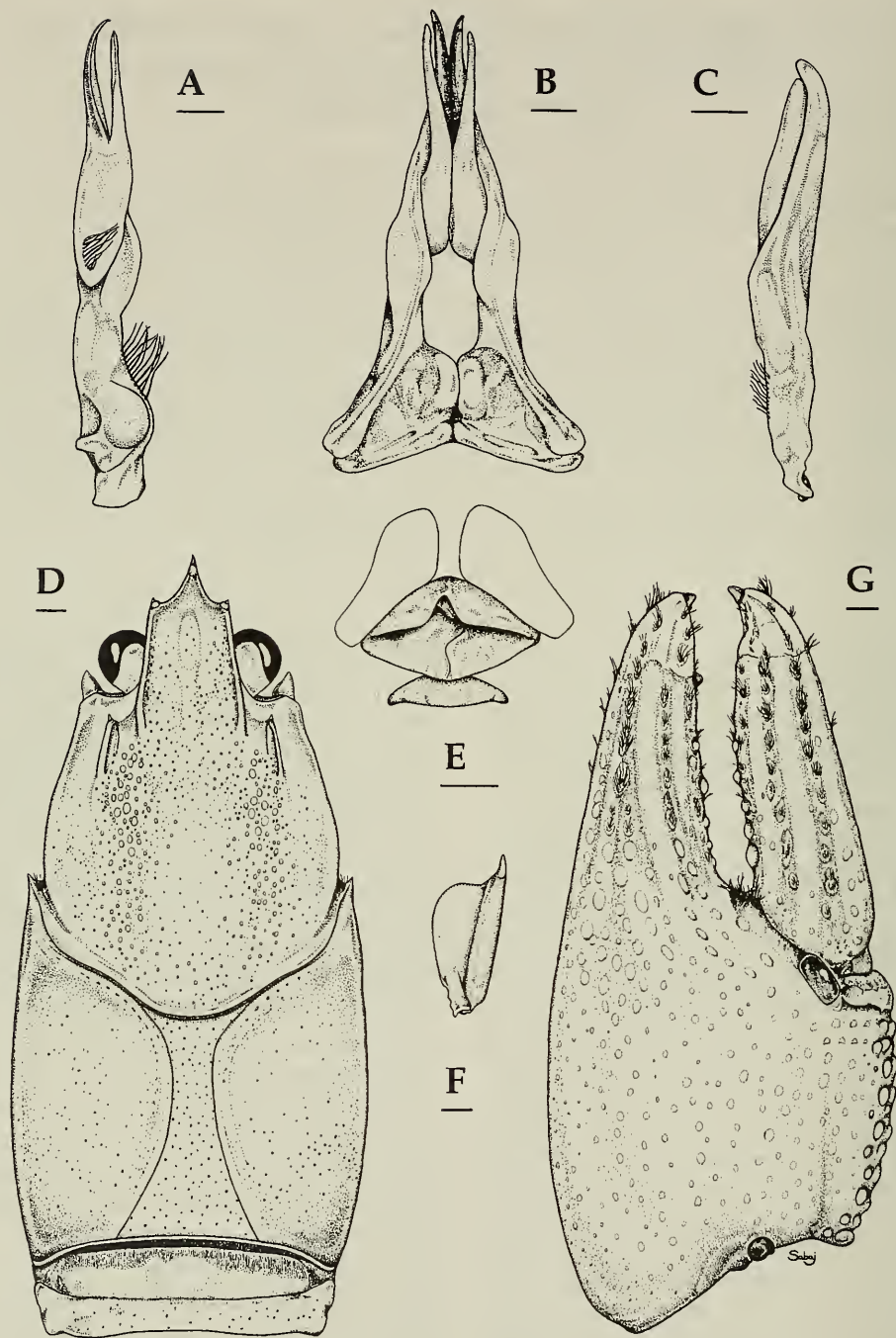


Fig. 1. *Orconectes burri*, new species: A, Mesial view of first pleopod of form I male; B, caudal view of first pleopods of form I male; C, Lateral view of first pleopod of form II male; D, Dorsal view of carapace; E, Annulus ventralis; F, Dorsal view of right antennal scale; G, Dorsal view of left chela (note- small tufts of setae over mesial margin of palm, dorsal, dorsomesial, and dorsolateral surfaces not shown). A, D, F, G of holotype (INHS 6663); B, topotype (INHS 6662); C, morphotype (INHS 6659); E, allotype (INHS 6664). Scale bars beneath letters equal 1 mm.

Table 1.—Measurements (mm) of *Orconectes burri*, new species.

	Holotype	Allotype	Morphotype
Carapace			
Total length	26.7	24.1	21.9
Postorbital length	21.3	18.8	16.7
Width	13.9	12.7	10.6
Height	12.2	10.8	9.3
Areola			
Width	1.5	1.4	1.4
Length	8.7	7.4	6.7
Rostrum			
Width	3.8	3.5	3.3
Length	6.4	6.0	5.5
Chela, left			
Length, palm mesial margin	8.5	5.7	4.8
Palm width	10.7	7.2	6.0
Length, lateral margin	23.3	15.5	14.2
Dactyl length	12.8	8.3	7.8
Abdomen			
Width	12.5	12.8	9.2
Length	30.4	27.8	23.7

and dorsolateral surfaces, and fingers; dorsal surfaces of fingers with well defined longitudinal ridges (Fig. 1G). First pleopods of form I male symmetrical, extending to posterior edge of bases of second pereopods when abdomen flexed. First pleopod of form I male without shoulder on cephalic surface at base of central projection; central projection corneous, constituting 22.2–29.2% ($\bar{X} = 26.4$, $n = 9$, $SD = 2.1$) of total length of first pleopod, arched caudodistally, tapering to a pointed tip, tip at 90° angle to main shaft of pleopod and extending to or slightly overhanging distal end of mesial process; mesial process straight and slightly subequal in length to central projection, non-corneous, tapering to an acute tip (Fig. 1A). First pleopod of form II male non-corneous, extending to posterior edge of bases of second pereopods when abdomen flexed; central projection weakly arched caudodistally, mesial process straight and subequal in length; both elements tapering

to rounded tips (Fig. 1C). Annulus ventralis immovable, subrhomboidal; cephalic half with wide median trough and 2 caudally directed protuberances overhanging centrally located fossa; sinuate sinus running from left corner of fossa to caudal edge (Fig. 1E).

Description of holotypic male, form I.—Body slightly depressed dorsoventrally, carapace wider than abdomen (13.9 and 12.5 mm, respectively). Greatest width of carapace larger than height at caudodorsal margin of cervical groove (13.9 and 12.2 mm, respectively). Postorbital carapace length 80.0% of length of carapace. Areola 5.8 times longer (8.7 mm) than wide (1.5 mm) with 6 punctations across narrowest part; length of areola 32.6% of total length of carapace. Rostrum densely covered by setiferous punctations, slightly excavated dorsally, weak carina present; margins thickened, distal halves straight and slightly converging, terminating in corneous spines, proximal halves slightly convex. Acumen terminating in upturned corneous spine and reaching midpoint of antennular peduncle. Postorbital ridges well developed, terminating in corneous spines. Suborbital angles weakly developed, forming broadly rounded projections. Cervical spines corneous; dorsal and branchiostegal areas of carapace densely punctate.

Abdomen longer than carapace (30.4 and 26.7 mm, respectively). Cephalic section of telson with 1 movable and 1 immovable spine in each caudolateral corner. Protopodite of uropod with spine extending over endopodite and spine in caudolateral corner extending over exopodite. Caudal margin of cephalic section of exopodite with numerous fixed spines (13) and 1 movable spine in caudolateral corner. Lateral margin of endopodite terminating in spine; endopodite with prominent median ridge terminating in premarginal spine. Dorsal surfaces of telson and uropods setiferous.

Antennal scale broadest distal to mid-length, distal margin at 90° angle to lateral margin, thickened lateral margin terminat-

ing in large corneous spine. Right antennal scale 5.5 mm long, 2.3 mm wide.

Mesial surface of palm of left chela with 2 rows of tubercles, 9 tubercles in mesial row, 9 tubercles in dorsomesial row, and 3 small widely interspersed tubercles lateral to dorsomesial row. Mesial, dorsal, and lateral surfaces of chela covered with numerous setiferous punctations; ventral surface with scattered punctations. Dorsal and ventral surfaces of finger of propodus with submedian longitudinal ridges flanked by setiferous punctations; basal half of opposable margin with 1 weakly developed tubercle and 4 well developed tubercles; 1 corneous tubercle at midlength between distal-most tubercle and distal tip of finger. Dorsal and ventral surfaces of dactyl with submedian longitudinal ridges flanked by setiferous punctations; basal half of opposable margin with 5 well developed tubercles, first and fourth tubercle from base of dactyl slightly larger than remaining 3. Finger of propodus and dactyl with subterminal corneous tip.

Carpus with deep oblique furrow dorsally; mesial margin with 1 large corneous procurved spine just distal to midlength; ventral surface with 1 corneous spine just lateral to midlength of distal margin, 1 spine just mesial to midlength of distal margin. Dorsodistal surface of merus with 2 corneous spines: ventral surface with 2 large corneous spines just distal to midlength of ventrolateral margin and mesial row of 7 spines, some corneous; row terminating in large corneous spine; small corneous tubercle at distolateral corner. Ischium with 1 corneous spine just proximal to midlength of mesial margin and 1 large tubercle on distal end of mesial margin.

Hook on ischium of third pereopod only; hook simple, overreaching basioischial articulation and not opposed by tubercle on basis. First pleopod as in Diagnosis, reaching to posterior edge of base of second pereopods when abdomen flexed.

Description of allotypic female.—Differing from holotype as follows. Areola constituting 30.1% of length of carapace and

5.3 times longer than wide with 7 punctations across narrowest part. Postorbital carapace length 77.2% of length of carapace. Dorsomesial row of tubercles along palm of left chela with 6 tubercles. Tuft of long setae at base of finger of propodus. Ventral surface of left carpus with 2 corneous spines along distal margin. Ventrolateral margin of left merus with mesial row of 5 spines, some corneous. Ventral surface of merus with large corneous spine at distolateral corner.

Sternum between third and fourth pereopods narrowly V-shaped. Postannular sclerite 1/2 as wide as annulus ventralis (described in Diagnosis). First pleopod uniramous, barely reaching caudal margin of annulus when abdomen flexed.

Description of morphotypic male, form II.—Differing from holotype as follows. Areola constituting 30.6% of length of carapace and 4.8 times longer than wide. Postorbital carapace length 77.0% of length of carapace. Dorsomesial row of tubercles along palm of left chela with 8 tubercles. Dorsodistal margin of carpus with 1 corneous spine just mesial to carpus/chela articulation joint.

Hook on ischium of third pereopod not overreaching basioischial articulation. Left fourth and fifth pereopods detached, right fifth pereopod detached. First pleopod as described in Diagnosis.

Size.—The largest specimen examined is a 33.5 mm total carapace length (CL) form I male. Females ($n = 11$) range in size from 13.0 to 29.7 mm CL. Form I males ($n = 10$) range from 14.9 to 33.5 mm CL. Form II males ($n = 7$) range from 14.0 to 25.2 mm CL.

Color.—Dorsal and lateral surfaces of cephalothorax, abdomen, and tail fan densely mottled with tan, light brown, and dark brown patches of varying size. Dorsum with one large laterally elongate dark brown patch just anterior to areola. Cephalothorax with dark brown dorsolateral U-shaped saddle connected at caudal margin and extending to midlength of lateral sur-

faces. Saddle discontinuous and mottled anterior to midlength. Dorsal and lateral surfaces of chelae, carpus, and merus mottled as cephalothorax and abdomen. Large rounded tubercle at carpus/chela articulation joint at dorsoposterior margin of chelae dark blue to black. Fingers of chelae with orange tips followed proximally by wide black bands. Dorsal surfaces of pereopods tan and mottled with small light brown patches. Ventral surfaces of chelae, cephalothorax, and abdomen cream to white.

Type locality.—Wildcat Creek at Kentucky Hwy. 280, 12.6 km E Murray, Calloway County, Kentucky. Holotype was collected from under an exposed tree root mass along the north bank, approximately 5 m downstream of the bridge. The allotype was collected from woody debris that had accumulated just upstream of the bridge. At the time of collection, Wildcat Creek ranged in width from 8–10 m with an average depth of 0.4 m. A small exposed shoal with woody vegetation occurred just upstream of the bridge. Substrate at the type locality was dominated by sand and gravel. Gravel substrates were predominantly found in shallow riffles while sand was found in slower flowing runs and pools. Stream banks were generally steep and well vegetated.

Disposition of types.—The holotype, allotype, and morphotype are deposited in the Illinois Natural History Survey Crustacean Collection (INHS 6663, INHS 6664, and INHS 6659, respectively), as are the following paratypes; 2 ♂ I, 1 ♂ II, and 1 ♀ (INHS 6665). Paratypes consisting of 1 ♂ I and 2 ♂ II (USNM 260869) and 2 ♂ II, 11 juvenile ♂, 1 female, and 2 juvenile ♀ (USNM 148718) are deposited at the National Museum of Natural History, Smithsonian Institution, Washington, D.C. The localities and dates of collection are provided in the following Range and specimens examined section.

Range and specimens examined.—*Orconectes burri*, new species, is confined to the Blood River system (Tennessee River

Drainage) in western Kentucky and Tennessee (Fig. 2). From its headwaters originating in Henry County, Tennessee, the Blood River flows northeasterly across the state line and through Calloway County, Kentucky. This relatively small drainage is best characterized as lowland stream habitat with minimal gradient (Burr and Warren 1986). A large portion of the main channel is embayed at its mouth by Kentucky Lake. Headwaters and tributaries of the Blood River drain Tertiary Porters Creek Clay/Clayton formations and Cretaceous McNairy Sand formations while the main channel flows through Quaternary Alluvial deposits. In western Kentucky and Tennessee the Porters Creek Clay/Clayton and McNairy Sand formations occur as a thin (16–32 km wide) strip of land that roughly coincides with the divide between eastward flowing tributaries of the lower Tennessee River (and the northern flowing Clarks River) and westward flowing tributaries of the Mississippi River. Extensive collecting in the lower Tennessee River drainage of western Tennessee and Kentucky by the authors and a search of holdings in the National Museum of Natural History have failed to document the presence of *O. burri* outside the Blood River drainage. In tributaries of the Tennessee River south of the Blood River, the species is replaced by *Orconectes (Orconectes) pagei* Taylor & Sabaj, 1997. To the north, *O. burri* is replaced by a disjunct population of *O. (Procericambarus) durelli* Bouchard & Bouchard, 1995.

A total of 92 specimens has been examined from the following six locations in Tennessee and Kentucky: TENNESSEE: Henry County: 1) INHS 5815, North Fork Blood River at Blood River Rd., 6.4 km ENE Puryear, 15 Jul 1996 (6 juvenile ♂, 2 ♀, 10 juvenile ♀); 2) INHS 6659, INHS 5822, USNM 260869, Middle Fork Blood River at Mt. Pleasant Rd., 6.4 km E Puryear, 8 May 1996 (morphotype; 3 ♂ I, 10 ♂ II; 1 ♂ I, 2 ♂ II paratypes to USNM); KENTUCKY: Calloway County: 3) INHS 6663, INHS 6664, INHS 6665, INHS 6662,

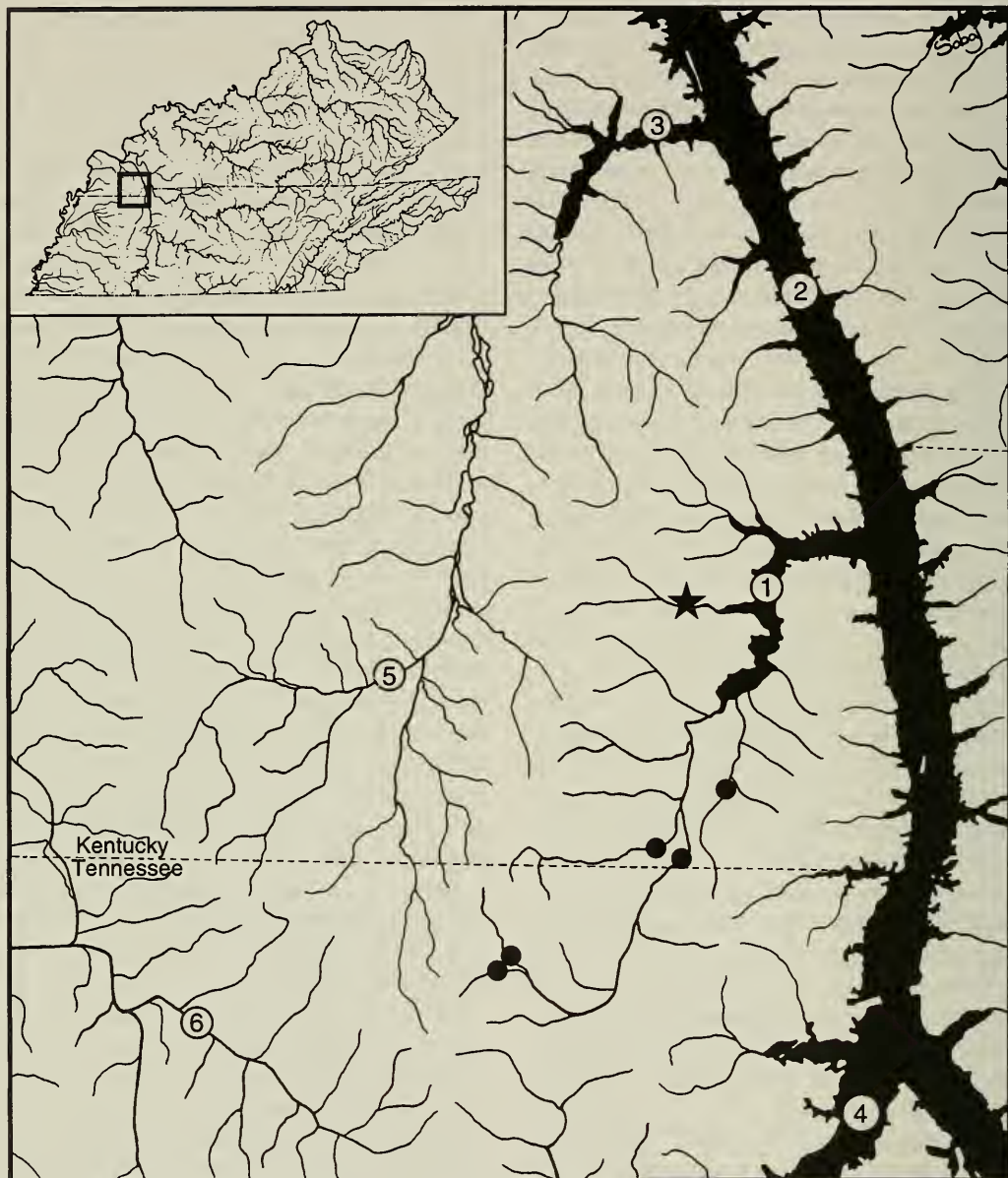


Fig. 2. Known range of *Orconectes burri*, new species. Type locality denoted by star. 1 = Blood River, 2 = Tennessee River (Kentucky Lake), 3 = Jonathan Creek, 4 = Big Sandy River, 5 = East Fork Clarks River, 6 = North Fork Obion River.

Wildcat Creek at KY Hwy. 280, 12.6 km E Murray (type locality), 26 Oct 1997 (holotype; allotype; 2 ♂ I, 1 ♂ II, 1 ♀ paratypes; 4 ♂ I, 4 ♂ II, 16 ♀, 3 juvenile ♀); 4) INHS 6667, Beechy Creek at KY Hwy. 121, 7.7

km SW Hamlin, 26 Oct 1997 (2 ♂ I, 2 ♀); 5) INHS 6669, McCullough Fork at State Line Rd., 5.2 km SSW New Concord, 26 Oct 1997 (1 ♂ I, 4 ♀, 1 juvenile ♀); USNM 148718 (2 ♂ II, 11 juvenile ♂, 1 ♀, 2 ju-

venile ♀, all paratypes); 6) INHS 5919, Blood River at Grubbs Rd., 0.3 km N KY-TN state line, 31 Mar 1997 (2 ♂ I).

Etymology.—Named in honor of Dr. Brooks M. Burr, Professor of Zoology and Curator of Fishes at Southern Illinois University at Carbondale. Dr. Burr is an avid naturalist with an intense interest in all aquatic organisms. This interest, coupled with his extensive collecting in the creeks and rivers of Kentucky over the past 20 years, has contributed greatly to our knowledge of the crayfishes and other aquatic species within the state.

Habitat and life-history notes.—*Orconectes burri*, new species, occurs in small to medium-sized streams with substrates of sand and gravel. Within these streams, the species was most commonly encountered in woody debris piles or woody vegetation root masses along stream banks. At site #2 (see Range and specimens examined) the species was collected from under large riprap immediately downstream of the bridge.

Form I males have been collected in the months of March, May, and October. Juveniles were commonly encountered in July. Most *O. burri* collections were composed of two distinct year classes, strongly suggesting a two-year life cycle for the species. No ovigerous females or females bearing young have been collected.

Crayfish associates.—The following species were collected from habitats containing *O. burri*: *Cambarus (Lacunicambarus) diogenes* Girard, 1852, and *Procambarus (Ortmannicus) acutus* (Girard 1852).

Variation.—Several ontogenetic variations are observed in *O. burri*, new species, none of which shows any geographic patterns of distribution. In smaller individuals the acumen is usually longer, the U-shaped saddle pattern on the cephalothorax is more clearly defined, and fewer tubercles occur along the mesial margin of the palm. In addition to the ontogenetic variation, a few individuals had two or three tubercles lateral to the dorsomesial row of tubercles along the mesial margin of the palm, and

several females had a sinuate sinus running from the right corner of the fossa of the annulus ventralis.

Comparisons.—*Orconectes burri* differs from all other members of the genus *Orconectes* in the shape of the form I male pleopod. The pleopod of *O. burri* is unique in possessing the following combination of characteristics: terminal elements moderately long, central projection comprising 22 to 29% of total length of pleopod; both elements subparallel to main shaft of pleopod; central projection weakly arched caudadistally, tapering to a pointed tip, tip at 90° angle to main shaft of pleopod and either even with or slightly overhanging distal end of mesial process. In addition to the unique shape of the form I pleopod, *O. burri*, new species, differs from other members of the subgenus *Crockerinus* by possessing an antennal scale that is widest distal to midlength and with a distal margin forming a 90° angle with lateral margin.

Relationships.—The form I male pleopod of *O. burri* is most similar in length and general shape to those of members of the subgenus *Crockerinus*, and we assign *O. burri*, new species, to that subgenus. In his subgeneric reorganization of the genus *Orconectes*, Fitzpatrick (1987) subdivided *Crockerinus* into five groups: Sanbornii, Marchandi, Propinquus, Rafinesquei, and Shoupi. Following Fitzpatrick's (1987) hypothesis that characters associated with amplexus are most useful for inferring phylogenetic relationships, we believe that *O. burri*, new species, most likely belongs to the Rafinesquei group. *Orconectes burri*, new species, shares with other members of the Rafinesquei group the following characters: central projection of form I male pleopod comprising 22 to 29% of total length of pleopod, distal tip of central projection arched caudally, and distinct trough through cephalic half of annulus ventralis. The placement of *O. burri*, new species, in the Rafinesquei group also is supported biogeographically given that it occupies a range closer to those of other members of

the Rafinesquei group than to other members of the subgenus. With the exception of *O. rafinesquei*, which inhabits the upper Rough River drainage of west-central Kentucky, all members of the Rafinesquei group occur in the lower Cumberland, Tennessee, and Ohio river drainages of extreme western Kentucky and southern Illinois (Hobbs 1989). Using morphology alone, we are unable to determine the closest relative of *O. burri*, new species, because the shape of its form I pleopod is equally different from the pleopods of all other members of the Rafinesquei group. Other characters such as the shape of the rostrum, areola, and chelae offer no additional clues to relationships. The rostrum of *O. burri*, new species, is similar to those of all other members of the group while the areola and chelae are unique to the group in that the areola is generally wider and the chelae are stockier with shorter fingers.

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tional Museum of Natural History, Smithsonian Institution.

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